

A Simple, Four-Band IF/Transverter Switch

By Jim Aguirre (W7DHC)

The trouble with transverters is that they grow on you..."grow" as in one becomes two, then three or even four. Adding bands by adding transverters is a quick and easy way to expand your presence on the VHF, UHF and microwave bands. It can also complicate your operations by adding complexity to the mix.

Unless you want to use separate IF rigs for each transverter, you'll need a way to switch a single IF between several transverters. I suppose you could take the minimalist route and simply connect and disconnect the coax and PTT line from the transverter and move it to another, but this is unduly time-consuming in a contest situation and is certainly prone to operator error.



Fig.

1 – A simple, four-band IF/transverter switch

Over the years, I've used several switching schemes for transverters, but they all involved separate switching of RF and PTT lines. As a rover, I frequently found myself with RF going to one transverter, but the PTT tripping a different one. That's not good!

Long-time friend...and fellow rover competitor...N7CFO discovered that a standard ceramic wafer switch and a Daiwa CS-401 four-position coax switch had the same 30 degree rotation between throws. He rigged up a plywood box in his rover truck, using one of each, coupled together to switch both RF and PTT at the same time. I liked that idea, but the plywood box concept didn't work for my application. I decided to see if the switches could be combined into one compact unit. The result is shown in Figure 1.

The purpose of the remaining part of this discussion is not to provide a step-by-step instruction on how to duplicate my unit. Rather, it is to provide enough general information to adapt this idea to your specific needs. While switching details differ among the various transceivers used as IF rigs, the general concept can be applied in virtually all cases. See Figure 6 at the end of the article for a suggested parts list.

Coax switches

While I have not conducted an exhaustive search for alternatives to the Daiwa CS-401 coax switch, it's the only one I have found that is suitable for this application. Both MFJ

and Alpha Delta offer similar switches but they have two significant differences that make them unsuitable for this project.

First, they do not have the 30-degree throw between positions needed to match them with a standard 4P3T rotary switch. Secondly, both have a center-off position that grounds the input, adding a potential rig-damaging position if you accidentally transmit into a dead short. For my rover operation, I prefer to keep things as “fool resistant” as possible.



Unfortunately, it appears that the Daiwa CS-401 (Figure 2) is no longer being carried by amateur radio dealers...at least that I could find during a web search. That's not surprising as the last price I saw for a new one was in the \$150 range.

The good news is that these switches show up frequently at hamfests and on eBay. While writing this article, I saw one listed on eBay. It eventually went for \$32. I have bought them at hamfests for \$20 - \$40.

Since these switches are pretty “bulletproof,” buying one at a hamfest isn't taking much of a chance. If the switch snaps firmly between positions and doesn't show a high resistance through the contacts, it should be OK. I usually carry a small VOM and check for continuity and high resistance just to be sure. Avoid those that have the white screw seals broken or otherwise appear to have been disassembled. That could indicate a problem. Obviously, buying them on eBay doesn't provide an opportunity to check them out.

Wafer switches

Since this switch will only be used to switch the PTT line to the transverter, it doesn't need high-amperage contacts or high-voltage insulation. Ceramic, phenolic or even plastic-based switches should work just fine. There are a couple of other mechanical requirements, however.

First, the switch must have the requisite 30-degree throw between positions. That's pretty easy to verify as there should be a 90-degree rotation in three throws. Three snaps of the switch should produce 90 degrees of shaft rotation. In addition...and this is critical...you need a switch with a shaft that protrudes out the back far enough to take a shaft coupler. Most

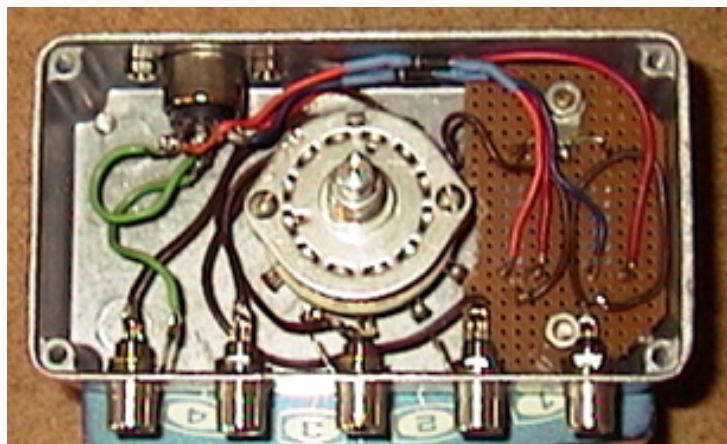


Fig. 3 – Wafer switch inside enclosure; relays are under perf board

ceramic switches have a 1/4-inch shaft that goes clear through the switch as do some of the phenolic and plastic units. (Some of them may have flats on two sides of the shaft, but that's OK.) Figure 3 shows a mounted switch.

While the 1/4-inch shaft is more convenient to work with...the CS-401 shaft is nominally 1/4-inch...you can use switches with other shaft sizes by finding or making a shaft couple to fit. Alternately, you can wrap some thin hobby brass into a bushing that fits inside the 1/4-inch shaft coupler to accommodate smaller shafts. This is a "junkbox project," so some ingenuity may be required.

Enclosures



CS-401switch

You will need something to enclose the wafer switch and keep it from rotating when you rotate the switch shaft. I used a 4.4" x 2.4" x 1.1" Hammond die-cast aluminum box (#1590B, Downeast Microwave, \$8.50) to contain the wafer switch, but any similarly sized sturdy plastic or metal enclosure could be used. Given a little of the ingenuity I just mentioned, you might also consider just using a flat plate above the wafer switch and mounting that assembly on the CS-401.

On my unit, the bottom of the small box enclosure is drilled to match the holes in the switch mounting ears and a pair of 1.5-inch tapped stand-offs are used to anchor it in position. With the threaded mounting collar on the wafer switch mounted snugly in the enclosure lid, everything stays nicely in place. Again, there are alternatives available for mounting. You could use hollow spacers and longer screws instead of tapped standoffs and short screws on each end. I thought of putting double-sided tape under the enclosure to secure it to the switch body, but have not found it necessary. Figure 4 shows the box mounted on the CS-401 coax switch. The black Delrin stand-offs I made are barely visible in the lower corners.

Transverter switching schemes

Every transceiver uses a different scheme for switching external devices. In some cases, (mostly older units) no switching capability is provided by the manufacturer and you need to install a relay or transistor to do the job. My unit was built primarily to be used with an Icom IC-706MkII; however, I wired the input side of the PTT switching circuit with a 5-pin mini-DIN receptacle to allow for different input cabling. As a result, I have also made it work with a Yaesu FT-817.

Whatever switching scheme your transceiver offers, I recommend using a separate reed relay to do the actual PTT switching. This isolates the transceiver switching from the actual PTT circuit and avoids the potential for damaging its internal circuitry with a higher-than-

anticipated switching. Some transceivers will only tolerate very low switching amperage and/or voltage. You will usually find this information in the operating manual.

I have found that Radio Shack's 275-233 reed relay works well and costs only \$2.79. The coil draws less than 10 mA on switching and the contacts will handle .5W...plenty for any transverter PTT. It will operate with as little as 8.4VDC or as much as 19.2VDC. If you need a lower switching voltage, this relay is available in a 5VDC version (RS 275-232). In practice, the transceiver external PTT switching circuitry activates the reed relay, closing the contacts and activating the transverter PTT.

In the IC-706MkII, the VSEND pin in the ACC socket goes to ground on transmit only when the rig is keyed on the 144 MHz or 432 MHz bands. That's perfect for switching a 144 MHz IF rig. You can also pick up a ground line and 12VDC from the accessory socket and that's all you need to make this switch work.

The IC-706MkII also has an HSEND pin in the ACC socket that only goes to ground only when the rig is keyed on one of the HF bands. This is useful for switching a 28 MHz IF transverter.

In some situations...and the IC-706MkII is one of them...a diode is required in the coil lead to prevent a reverse current flow. I have not spent the time to determine why, but I know it is required for the IC-706 series. Other transceivers may not need it.

BNCs on a Daiwa CS-401 Coax Switch?

Those who are especially observant will note that my completed IF/transverter switch shown in Fig. 1 uses a Daiwa CS-401 coax switch fitted with BNC connectors. They don't come that way from Daiwa!

I modified mine by unsoldering and removing the standard SO-239 connectors from the switch body (they are held in the switch body with set screws), machining bushings to fit the existing holes and installing chassis-mount BNC connectors.

Since DEM transverters use BNC for RF input, I felt it would make sense to modify my switch so that I could use easily obtainable BNC-to-BNC connecting cables. You can accomplish the same thing by using BNC adapters that screw onto the SO-239's. I never seem to do things "the easy way."

The reed relay PTT line is routed to the common position on the wafer switch and the four switch outputs are wired to individual RCA jacks to control the four transverters. Certainly, you can use other connectors. As it happens, DEM transverters use RCA jacks for PTT switching, so inexpensive, pre-wired RCA-to-RCA cables can be used without modification.

Conclusion

This switch works very well for me in a rover application and I have used it in the shack as well. In my unit, I also included a dedicated 28 MHz circuit to switch my DEM 222-28 transverter. RF is fed directly to the DEM 222-28 transverter from the HF coax connector on the IC-706MkII. When the rig is keyed on 28 MHz, the HSEND pin activates a second relay I included in the box and feeds an IF signal to the transverter as well as keying the dedicated PTT line.

Good luck in building your own “Simple, four-band IF/transverter switch.” If you have questions or need some advice regarding this project, please feel free to contact me at w7dhc@arrl.net.

Fig. 6 - Suggested Parts List

- ◆ *Daiwa CS-401 coax switch*
- ◆ *4P3T rotary wafer switch with 30° throw*
- ◆ *Knob of choice for ¼" shaft (Daiwa knob won't work)*
- ◆ *¼-inch shaft coupler*
- ◆ *Small enclosure (Hammond 1590D or equiv; DEM part # 1590B, \$8.50)*
- ◆ *2 ea 12 VDC reed relays (RS 275-233, \$2.79 ea)*
- ◆ *2 ea 1N4001 diodes or similar, if needed (RS 279-1101, \$.59 for 2)*
- ◆ *#18 hook-up wire*
- ◆ *5-pin panel mount DIN jack (Mouser Electronics? Mine was in the "junk box.")*
- ◆ *4 ea RCA jacks (Mouser Electronics? Mine were in the "junk box.")*
- ◆ *2 ea #8 FH machine screws & nuts**
- ◆ *2 ea 1.5" tubular spacers or tapped standoffs*

** Use ¾" long screws for tapped stand-offs or 2" long screws for tubular stand-offs.*